Jet Propulsion Laboratory
Enterprise Applications Office

Dr. Roger Lee

October 31, 2001

JPL Information Services
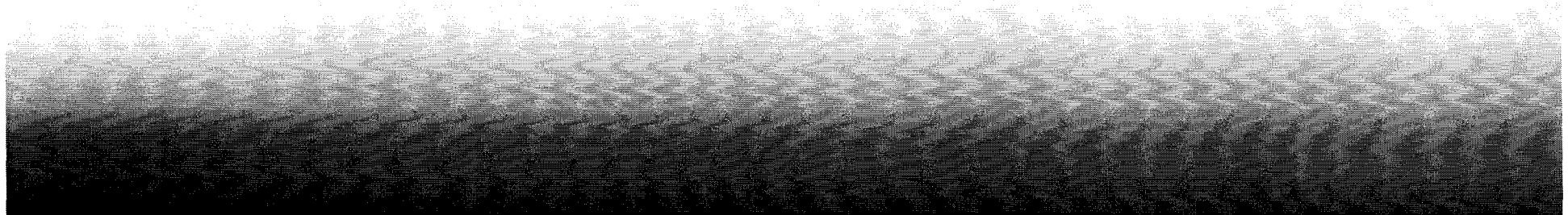
Outline

- Setting the context
- Knowledge Management
  - Knowledge capture
    - Personal knowledge capture
    - Project knowledge capture
  - Knowledge preservation
    - Document Management
    - Electronic Archiving
  - Knowledge distribution
    - *InsideJPL* portal
- Data Management
  - Metadata Service
  - Catalog and Archive Service
  - Object Service
  - Data Product Exchange
  - Data Access Service

JPL Organization
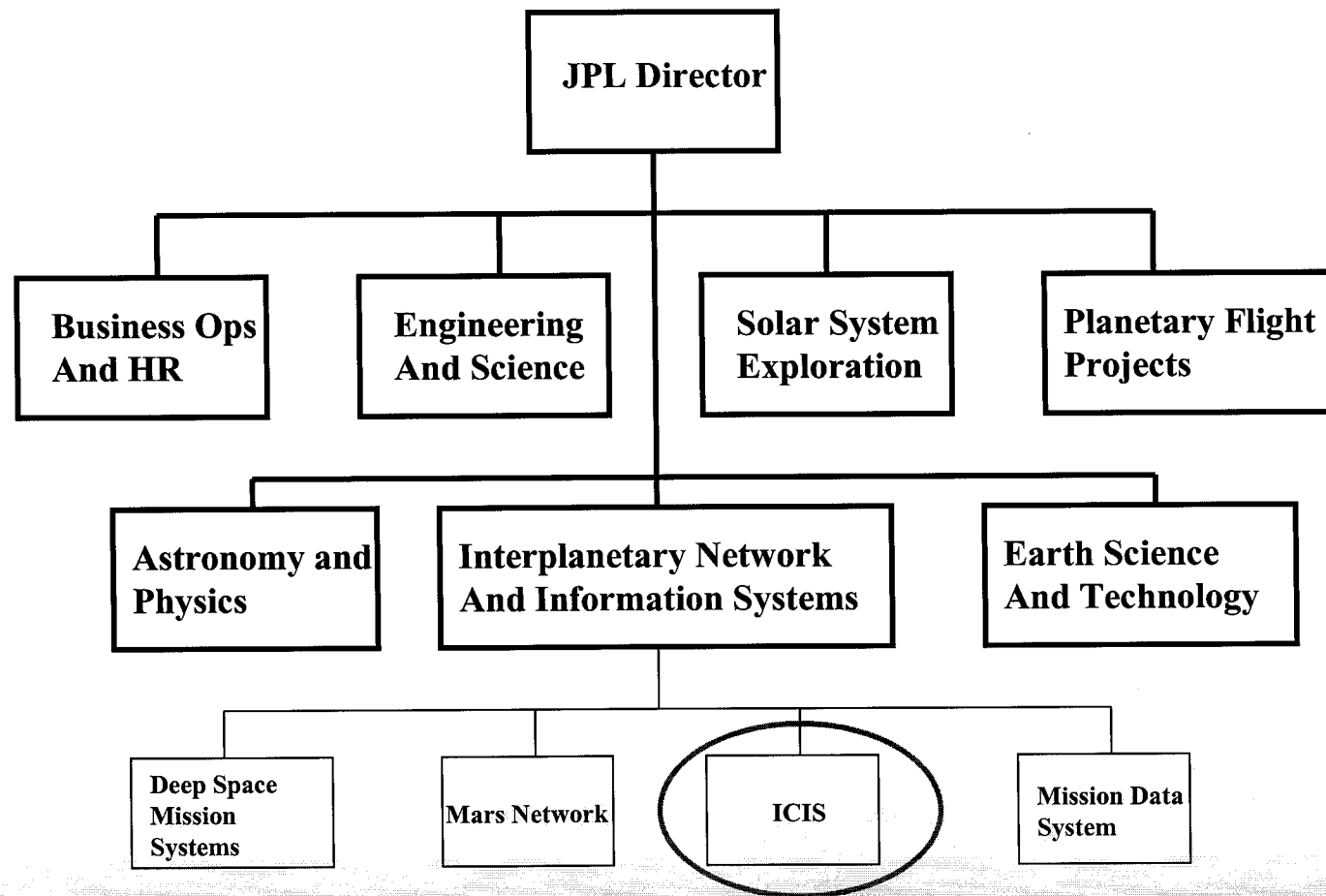
Institutional Computing and Information Systems (ICIS)

- Provides end-to-end information systems for employees and organizations at JPL
- Focus is on delivered products rather than R&D
- Employs COTS solutions where appropriate

Old IT Model For Projects

Large Projects
IT needs largely provided directly by the Project (Frequent reinvention of capabilities)

New IT Model For Projects

Small Projects Cost effective user of institutional IT resources
CSMISS, DNP, Proposal Center, etc. built on ICIS IT services
ICIS provides predictable, reusable foundational IT services

ICIS Functions

ICIS Manager/CIO

Information Technology Security (ITS)

IT security policy, requirements, guidelines and procedures

Planning and Liaison

One-stop shopping for projects
Coordinated planning
Training, education, outreach and communication

Architecture and System Engineering

Enterprise-wide IT architectures
Enterprise information modeling
Standardized engineering processes for ICIS

Enterprise Network and Telecommunications

Telecommunications
Network - high speed, wireless, video - intra & inter
Collaboration services - engineering, training

Institutional Computing

Desktop computing
High performance computing
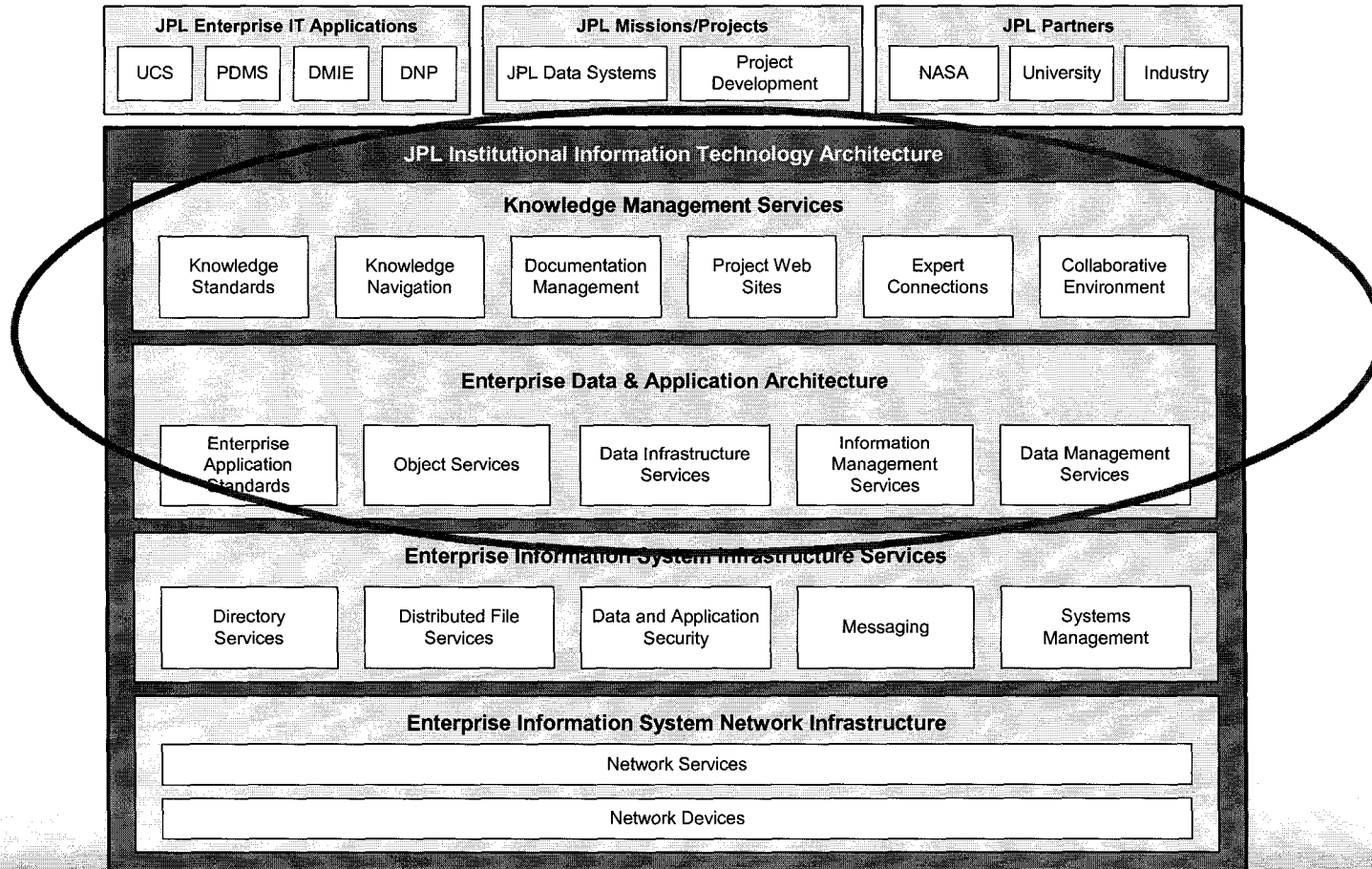
Enterprise Infrastructure

Services for projects, orgs and individuals - dir, sec,
msg, fil, smn, win

Enterprise Applications

S/W component creation, reuse, and curation
Development environments, application hosting
Knowledge management, e-commerce
Data access and data management services

950

JPL IT Architecture

JPL Enterprise IT Applications				JPL Missions/Projects		JPL Partners		
UCS	PDMS	DMIE	DNP	JPL Data Systems	Project Development	NASA	University	Industry

JPL Institutional Information Technology Architecture

Knowledge Management Services

Knowledge Standards	Knowledge Navigation	Documentation Management	Project Web Sites	Expert Connections	Collaborative Environment

Enterprise Data & Application Architecture

Enterprise Application Standards	Object Services	Data Infrastructure Services	Information Management Services	Data Management Services

Enterprise Information System Infrastructure Services

Directory Services	Distributed File Services	Data and Application Security	Messaging	Systems Management

Enterprise Information System Network Infrastructure

Network Services

Network Devices

Knowledge Management

- **Knowledge capture**
  - ◆ Personal knowledge capture
    - • Know-who database
    - • Larry's brain
    - • Personal knowledge organizers
  - ◆ Project knowledge capture
    - • Design maps
    - • Technical questions database
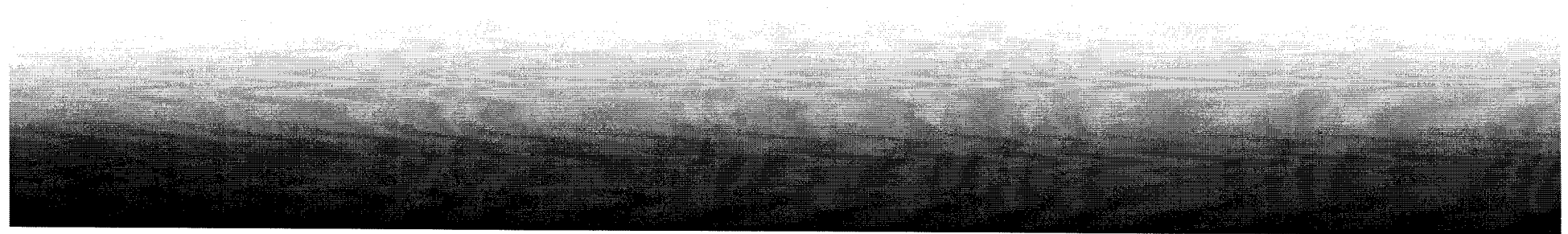- **Knowledge preservation**
  - ◆ Document Management
  - ◆ Electronic Archiving
- **Knowledge distribution**
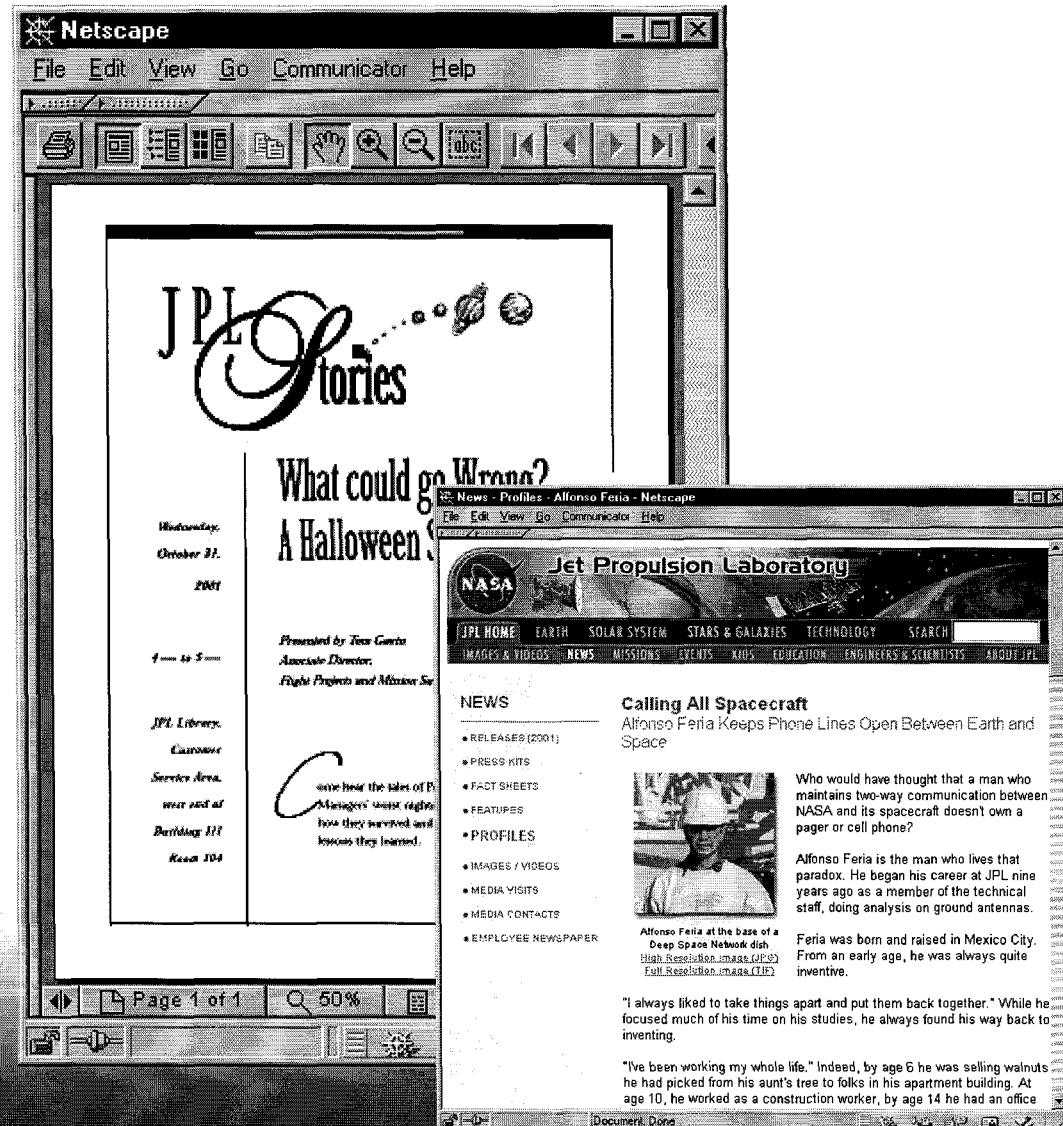 - ◆ *InsideJPL* portal

Knowledge Capture: Challenges

- Loss of key personnel
- Faster-Better-Cheaper
- Shortage of experienced personnel
- Changing organizational and external environments
- Availability of people
- Competing priorities

Existing resources

- JPL Stories/Storytelling
- Archives' Oral History Program
- Profiles

Know-Who Database

JPL Know Who - Netscape

File Edit View Go Communicator Help

JPL **Know** *Who*

JPL personnel possess expertise in a broad spectrum of Scientific, Engineering and other technical and non-technical areas. The JPL KnowWho will help you locate people with the expertise you need.

Home/Quick Search | Advanced Search | Add Profile | Modify Profile | Password Change | Help | Contact Us

Click on a category below or enter a name, subject area or other descriptor in

Quick Search

[Submit]

Exact Match? Yes ○ No ⦿ • Advanced Search

Technical

- Astrodynamics & Navigation
- Computer Science
- Detectors & Detector Systems
- Environmental Compatibility
- Materials Science
- Metrology
- Mission Design
- Operations
- Propulsion
- Robotics
- Systems Engineering

- Chemical Systems & Processes
- Control Systems
- Energy/Power
- Integration & Test
- Mechanical & Thermal
- Microdevices
- Numeric Modeling/Applied Mathematics
- Optics
- Reliability Engineering
- Science
- Telecommunications

Ins

- Facilities
- Health and Safety
- Industrial Relation
- Legal and Regula
- Office Profession
- Public Affairs
- Technical Inform

Related Sites: [Caltech Experts Guide   Publications]

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Help | Contact Us | Survey

Document Done

JPL Know Who - Browse form (10/2001) - Netscape

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JPL **Know** *Who*

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Technical: Operations:

Human-Computer Interaction / Interfaces

If you are FARROKH SHOAR, you can [Update] this information.

Employee Name:	FARROKH F SHOAR	**Nickname:**	
Org. No.:	3440	**Work Location:**	301-382K
Phone No.:	(818)354-5126	**Email Address:**	Farrokh.F.Shoar@jpl.nasa.gov
Organization Category:	- AVIONIC EQUIPMENT SECTION		
Working Title:	Sr. Electronics Design Automation Engineer		
Please contact me by:	☑ Email ☐ Phone	**Reviewed:**	Yes
Date Created:	05/22/2001	**Date Modified:**	05/23/2001

Technical Categories

(1) Computer Science:Applications & Use
(2) Computer Science:Automation/Control
(3) Computer Science:Distributed Computing
(4) Computer Science:Hardware
(5) Computer Science:Human-Computer Interaction/Interfaces
(6) Computer Science:Information Technology
(7) Computer Science:Modeling/Simulation
(8) Computer Science:Networks
(9) Computer Science:System Administration

Document Done

# Critical Personnel KC: "Larry's Brain"

- Pilot effort with outgoing JPL Deputy Director Larry Dumas
  - ◆ Covering topics such as
    - Faster-Better-Cheaper
    - TQM, Reengineering, ISO
    - Downsizing, outsourcing, zero-raises
    - Impact of the end of the cold war
  - ◆ Currently processing the interview sessions and compiling into publishable format
- Extremely valuable.
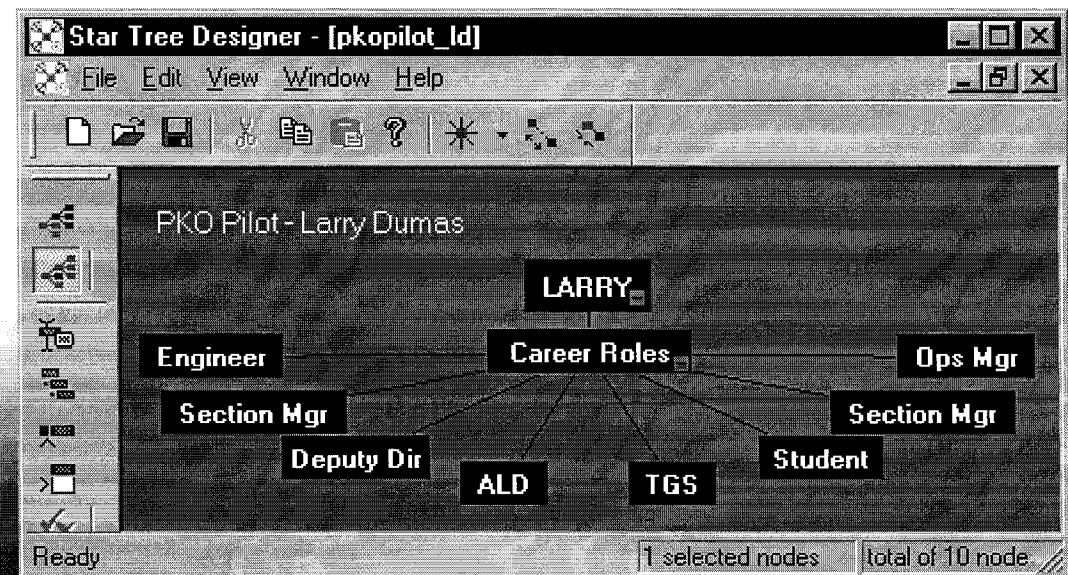- Assessing level of effort required and ability to expand

Personal Knowledge Organizers

■ Technology

- ◆ Emerging tools (e.g., Brain, Inxight) to organize and cross-reference electronic docs
- ◆ Routine use of PDAs, CD/RW, laptops
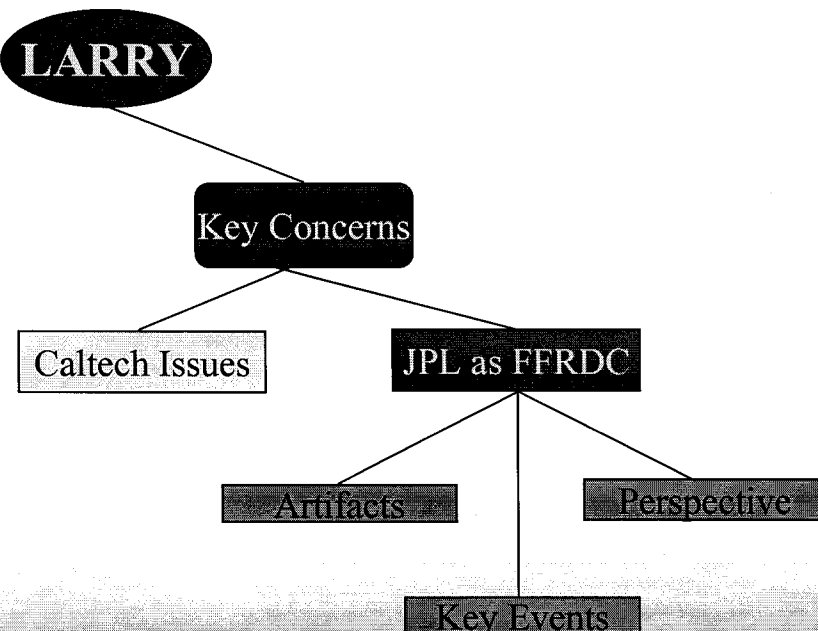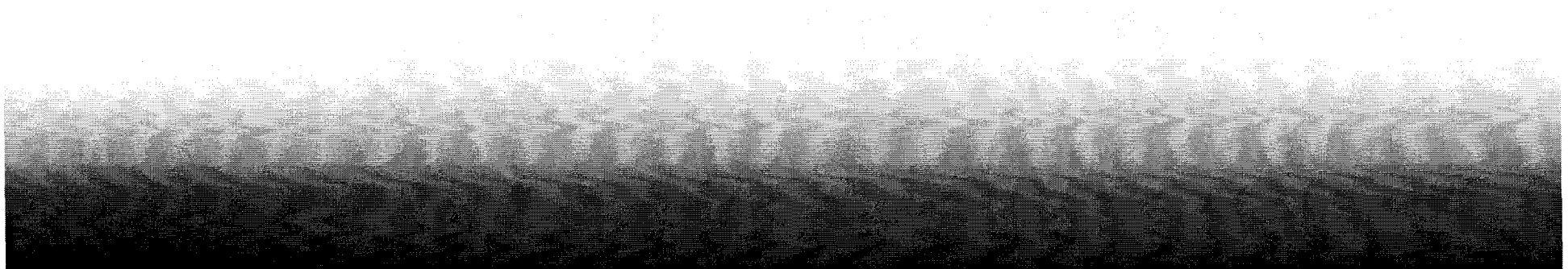

Inxight's "Star Tree"

Project Knowledge Capture

- Problem: Improving capture of design rationale, internal team commitments, and other relevant information

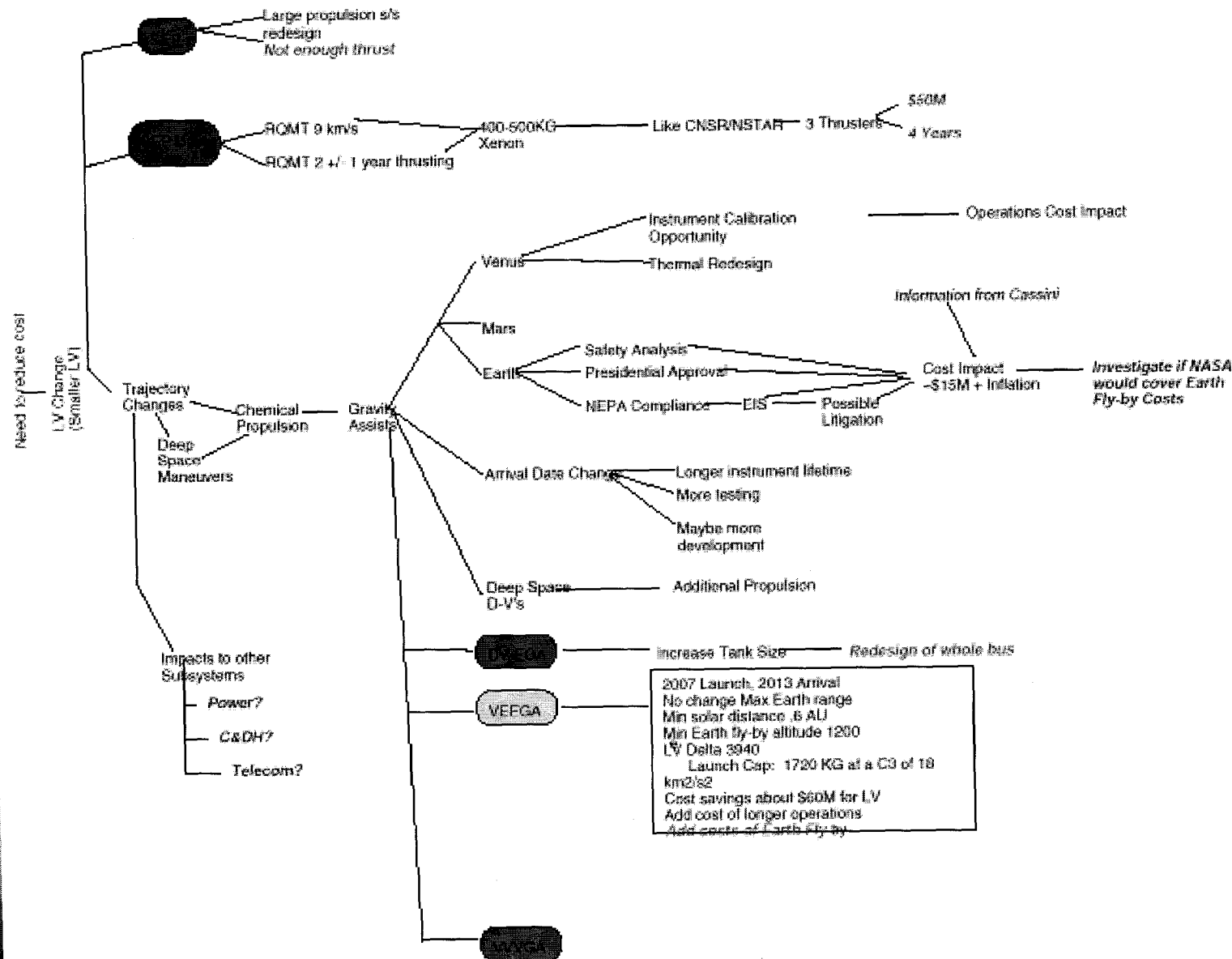- Current capabilities focus on managing what's captured – not on improving the capture
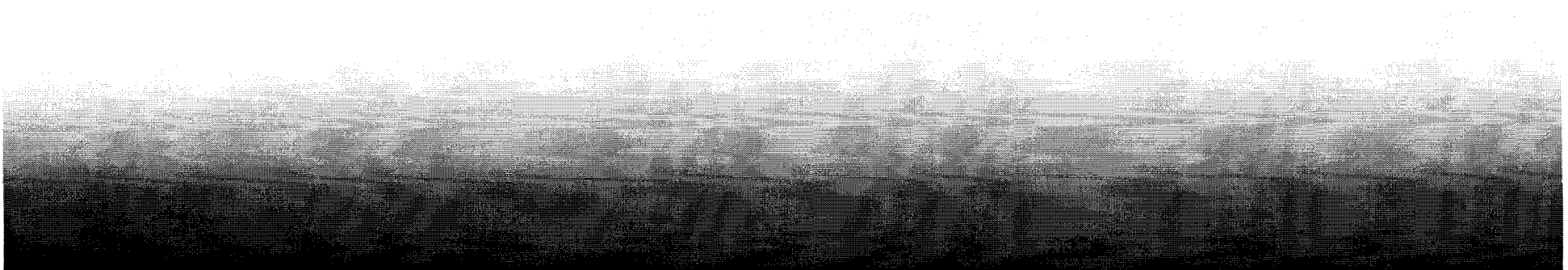
DKC: Pilot 1

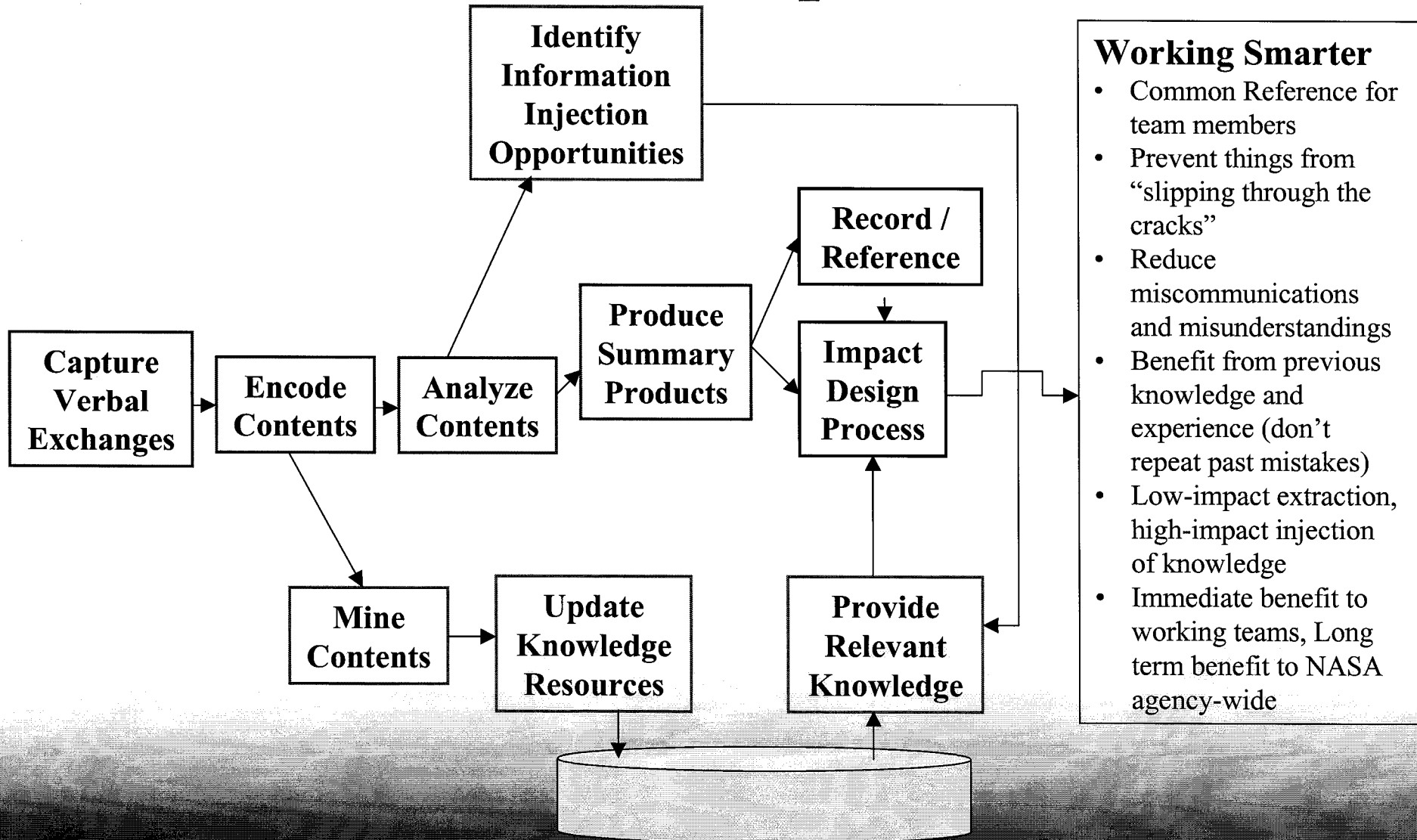■ Center for Space and Mission Architecture Design (CSMAD) Demo

◆ Used "script" from demo as transcript

◆ Analyzed manually

◆ Produced:

• Integrated Action Items/To-Do List

• List of Reference Materials

• Design Map

Sample Design Map

Large propulsion s/s redesign
Not enough thrust

ROMT 9 km/s
400-500KG Xenon
Like CNSR/NSTAR — 3 Thrusters
$50M
4 Years

ROMT 2 +/- 1 year thrusting

Instrument Calibration Opportunity ——— Operations Cost Impact

Venus
Thermal Redesign

Information from Cassini

Mars

Earth
Safety Analysis
Presidential Approval
NEPA Compliance — EIS — Possible Litigation

Cost Impact
~$15M + Inflation
Investigate if NASA would cover Earth Fly-by Costs

Need to reduce cost
LV Change (Smaller LV)

Trajectory Changes
Chemical Propulsion
Gravity Assists

Deep Space Maneuvers

Arrival Date Change
Longer instrument lifetime
More testing
Maybe more development

Deep Space D-V's ——— Additional Propulsion

Impacts to other Subsystems
Power?
C&DH?
Telecom?

Increase Tank Size ——— Redesign of whole bus

VEEGA

2007 Launch, 2013 Arrival
No change Max Earth range
Min solar distance .6 AU
Min Earth fly-by altitude 1200
LV Delta 3940
    Launch Cap: 1720 KG at a C3 of 18 km2/s2
Cost savings about $60M for LV
Addl cost of longer operations
Add costs of Earth Fly-by

DKC: Grand Concept

Identify Information Injection Opportunities

Record / Reference

Produce Summary Products

Capture Verbal Exchanges

Encode Contents

Analyze Contents

Impact Design Process

Mine Contents

Update Knowledge Resources

Provide Relevant Knowledge

Working Smarter
- Common Reference for team members
- Prevent things from "slipping through the cracks"
- Reduce miscommunications and misunderstandings
- Benefit from previous knowledge and experience (don't repeat past mistakes)
- Low-impact extraction, high-impact injection of knowledge
- Immediate benefit to working teams, Long term benefit to NASA agency-wide

DKC: Pilot 2, MSMS

■ Audio recorded, manual notes during team sessions

■ Produced:

◆ Integrated Action Items/To-Do List

◆ Raw/Summarized Notes

■ Results

◆ Attempted to manually transcribe (gave up)

- Had to rely on manual notes. Insufficient to effectively capture design rationale and other info

◆ Factor of 6 improvement on AI/To-Do

- Mixed reactions: Team needed process for volume of AIs

◆ "Fly-on-the-wall" difficult

- Acoustics, vocabulary, multiple conversations, being able to interpret what was said as decision/issue/other

Technical Questions DB

- Technical questions in disciplines applicable to flight projects
  - ♦ That could be asked during the design process or at a review
  - ♦ With the purpose of identifying and preventing problems from occurring
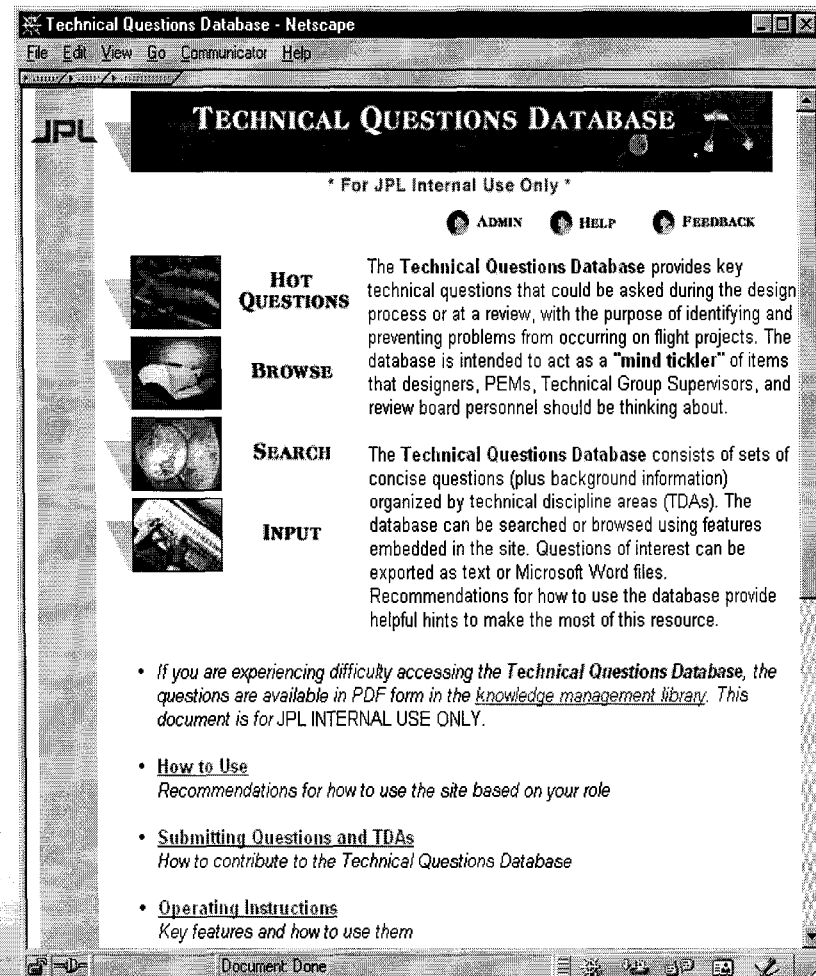
JPL Information Services

TQ DB Scenario

Technical Questions Database - Netscape
File Edit View Go Communicator Help

JPL **TECHNICAL QUESTION**

* For JPL Internal U

HOT QUESTIONS
The Technical Q
technical questio
process or at a re
preventing proble

BROWSE
database is inten
that designers, P
review board pers

SEARCH
The Technical Q
concise question
organized by tecl

INPUT
database can be
embedded in the
exported as text
Recommendation
helpful hints to m

- If you are experiencing difficulty accessing the
questions are available in PDF form in the kn
document is for JPL INTERNAL USE ONLY.

- How to Use
Recommendations for how to use the site bas

- Submitting Questions and TDAs
How to contribute to the Technical Questions

- Operating Instructions
Key features and how to use them

Document: Done

Technical Questions Database - Netscape
File Edit View Go Communicator Help

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Document: Done

Technical Questions Database - Netscape
File Edit View Go Communicator Help

Materials and Processes   352 Cheng   Hsieh

Question: Is there a Materials & Processes (M&P) engineering involvement in the design process?

Background:

Question: Does the material selected have the properties (mechanical, thermal, optical, etc.) necessary for the application? Are any alternative materials considered? Are there any processing constraints requiring consideration? Has the special precaution of materials being addressed (e.g., toxicity and brittleness of Be)? For materials with no prior relevant flight experience, have they been qualified for use in the mission environment?

Background:

Question: Has a Materials and Processes Identification and Usage List been prepared? For materials being used in "non-standard" applications, are Materials Usage Agreements or waivers needed?

Background:

Question: Has the potential for the materials to contaminate and adversely affect the performance of sensitive systems been evaluated? Is there a need for thermal vacuum bakeouts of structures and materials?

Document: Done

Document Management

- Look at the entire lifecycle of information necessary to manage information and support a rich authoring environment
  - Tools
  - Templates
  - Electronic Archiving
- Organizational document management based on a COTS product (Docushare)
  - 6500 active licenses
  - 101 organizations
  - 120,000 documents, 170 gigabytes of storage

JPL Information Services

Docushare

- Web-based
- Folder and file access control
- Search capability
- Version and write control
- Dynamic web page generation

Electronic Archiving

- Typical projects have only limited time to deal with artifacts as the project comes to a close.
- Archiving has three main customers:
  - Project
  - Other projects
  - The community at large
- Issues
  - Media
  - Capability to read archived material after time passes
  - Infrastructure to read archived material after time passes
  - Storage location
  - Indexing of materials
  - Ease of access

Inside JPL Portal

■ An enterprise information portal that organizes an employee's information in a customized way and dynamically displays

- ◆ Agency and Center news
- ◆ Directory of Center web space
- ◆ Events calendar
- ◆ Employee contact and directory information
- ◆ Mission and project information
- ◆ External news tailored to the user's needs
- ◆ Personalized information routinely used in daily work
- ◆ Quick access to web-based applications used frequently

Portal Specs and Functions

- **iPlanet Portal Version 3.0 Product**
  - Uses push technology to deliver most current information
- **25 Data Channels currently operational**
  - Sub portals planned for mission and organizational use
- **Contains JPL Web Space Directory**
  - Browsable institutional taxonomy of JPL intranet with most prominent sites
- **Initial delivery is an open portal**
  - Possible extension includes SSL Portal Gateway server for VPN usage to provide remote access through encrypted lines
  - Interface with external iPlanet LDAP Directory product for user authentication and personalization
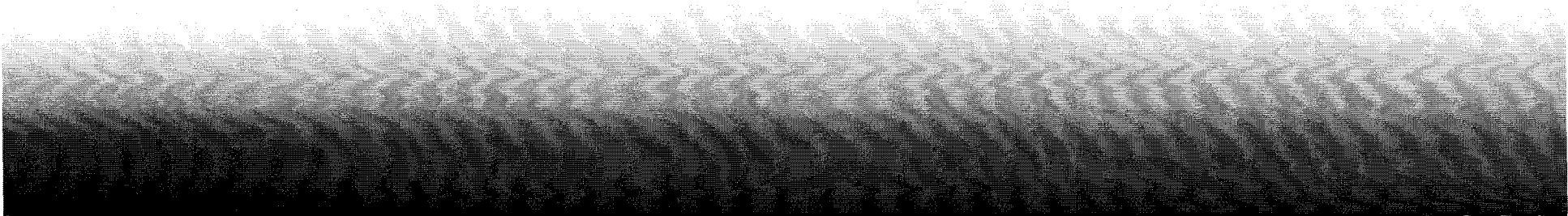
Web Search

- Four kinds of search
  - Taxonomy
  - Yellow-page
  - Intelligent organization of bookmarks
  - Search engine

Search Engine

- **Commercial Products:** Compass Server 3.0 for spidering internal web space and query capability

- **Document types catalogued**
  - ◆ HTML files, Microsoft Office formats, PDF's, plain text, databases accessed with the accompanying query interface (inc. Oracle)

- **Current catalogue has ~ 450,000 documents**
  - ◆ Use of filters to harvest best documents out of 1.5 million document total
  - ◆ Engineering trade off: partial text extraction vs. full text & more disk space

- **Future directions**
  - ◆ Log analysis for development of thesaurus, saved searches, more consistent use of metadata and access to meta data registry
  - ◆ Access to more repositories through remote calls to native search engines
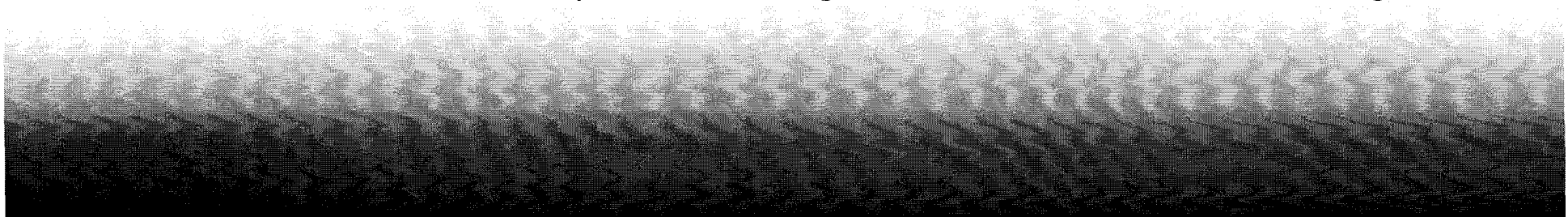
JPL Information Services

Inside JPL Beta Version

User Log In

Daily Planet

Most Commonly Accessed Business Links

Labwide Announcements

Engineering Links
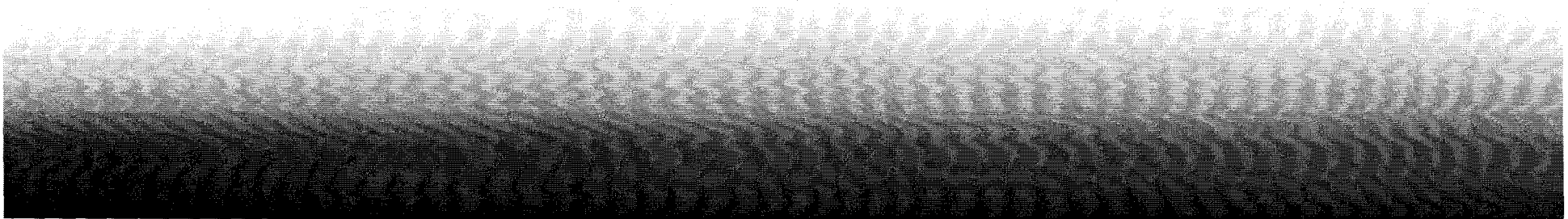
Headline News

Institutional Calendars

Institutional Search Engine

Other Channels:

- **Organization Channels**
  - *Division 32*
  - *IPN-ISD*
- **NASA News**
- **JPL Web Space Directory**

Data Management

- ■ Enable an integrated information architecture across science, engineering, and institutional applications
  - ◆ Integrate across data spaces (data, document, web, etc.)
- ■ Provide institutional services that promote interoperability of distributed data resources
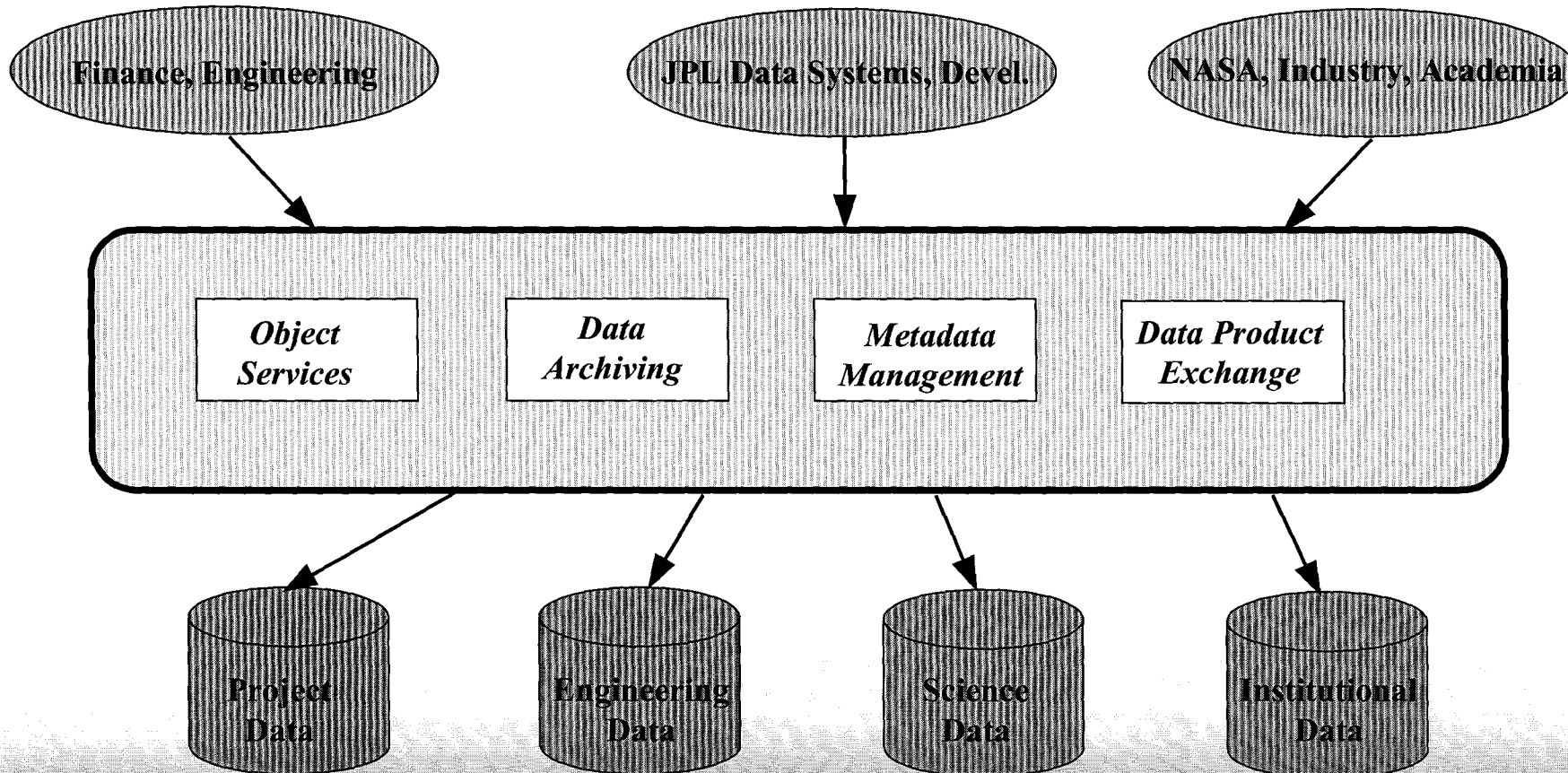- ■ Lay a foundation on which to build future enterprise applications

Enterprise Data Services

Enterprise Apps   Missions/Projects   JPL Partners

Finance, Engineering   JPL Data Systems, Devel.   NASA, Industry, Academia

| Object Services | Data Archiving | Metadata Management | Data Product Exchange |

Project Data   Engineering Data   Science Data   Institutional Data

JPL Data Repositories

Metadata Service

- **Provide a series of registries that allow for the management of data dictionaries, data elements, and resources**

- **Metadata registry (CMR)**
  - ◆ Data dictionary ingestion and management
  - ◆ Data element management
  - ◆ Data element relationship management

- **Resource registry**
  - ◆ Manages "profiles" of data system contents based on the data elements (e.g., maps data elements to data system resources)

Catalog and Archive Service

- Provide an active product storage and retrieval capability for missions and projects.
- Active archive allows one to interactively query the archive to retrieve stored data products
- Four major capabilities
  - Distributed access utilizing an API
  - Product type flexibility (e.g., archiving any blob)
  - Cataloging based on data elements (from Metadata Service)
  - Product-specific task execution (specialized for instantiations based on project need)
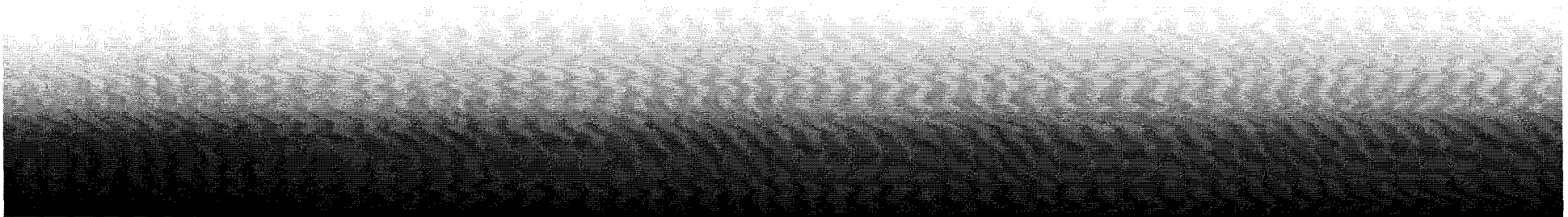
Object Service

- ■ Provide services that enable the building of enterprise applications and an information architecture.

- ■ Object service is composed of four parts:
  - ◆ Object naming registry
  - ◆ Object identifier assignment registry
    - • Unique identifiers for software components, data products, systems, etc.
  - ◆ Common enterprise data components
    - • Directory, security, property, project accounting, mission, engineering,...
  - ◆ Component hosting
    - • Application server and environment

Data Product Exchange

- Enable interoperability between two peer applications
- Support JPL-defined standards for data interchange
  - Common data structures
  - Common keywords
  - Standards for enterprise applications
- Use the Metadata service to describe the data that is being exchanged

Data Access Service

- Provides application access and management of data repositories in a distributed networked environment.
  - ◆ Oracle Database Hosting Service
    - An easy and inexpensive way for projects to quickly utilize robust database products, server and storage. Provides hardware, COTS software, database administration, system administration
  - ◆ Solaris Application Hosting
    - Provides full hardware, OS, COTS software, and mass storage support in selection, installation, maintenance and operations including middleware for distributed access.
  - ◆ Enterprise Storage
    - Abstract storage away from physical hosts for high system and data availability, rapid system deployment and scalability, and low total cost of storage ownership.Capacity over 600GB with 36GB disks, can be expanded to 1.5 TB .